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(71) Applicant (for all designated States except US): MYSTIX LIMITED [GB/GB]; Parkway House, 1 Pityme Business Centre, St. Minver, Wadebridge, Cornwall PL27 6PH (GB).

(72) Inventor; and

(75) Inventor/Applicant (for US only): DUFORT, John, Francis [GB/GB]; 91 Egloshayle Road, Wadebridge, Cornwall PL27 6AF (GB).

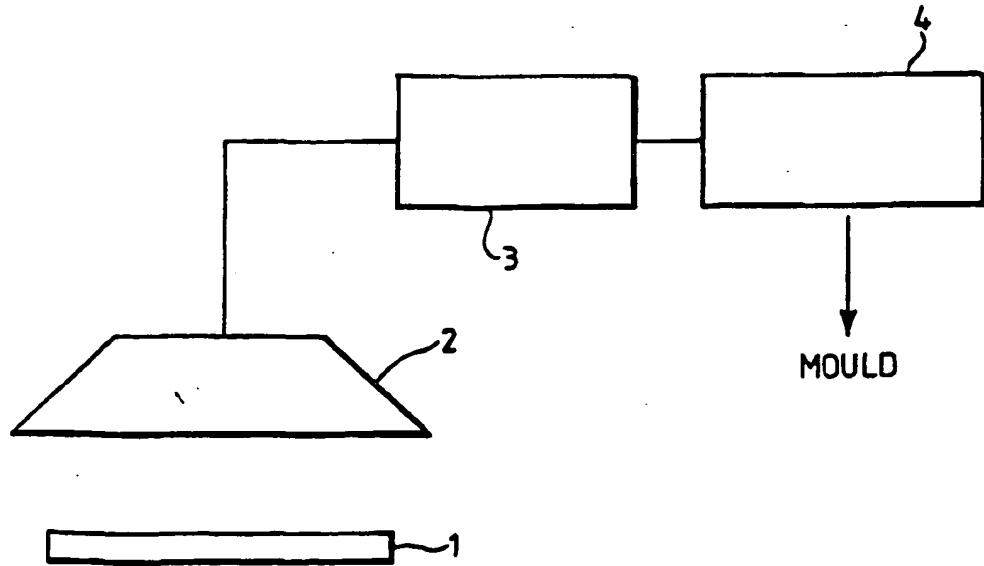
(74) Agent: HOWE, Steven; Lloyd Wise, Tregear & Co., Commonwealth House, 1-19 New Oxford Street, London WC1A 1LW (GB).

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(54) Title: LITHOPHANE-LIKE ARTICLE AND METHOD OF MANUFACTURE



(57) Abstract

A lithophane-like article and a method of forming such an article, for example formed of plastics, confectionery product, soap, wax or liquid, by determining the intensity of different points of an original image (1), and forming the article with a thickness at each point of the article related to the intensity of the corresponding point of the original image (1). Preferably, the article is formed by forming a mould, and moulding the article.

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LITHOPHANE-LIKE ARTICLE AND METHOD OF MANUFACTURE

In the late nineteenth and early twentieth centuries, lithophanes were formed from porcelain. These objects were pieces of porcelain which were formed with sections of various thickness. The porcelain was 5 fired at a very high temperature, resulting in the porcelain becoming translucent. By shining light through the porcelain from behind, as a result of the different thicknesses of the porcelain and therefore the different transmissivity of light through the porcelain, an image 10 is seen. In particular, the thicker areas of the porcelain are less transmissive to light than thinner areas, and so appear darker.

In the early part of the twentieth century, 15 lithophanes were formed by hand engraving wax with the relief corresponding to the areas of different brightness of the desired image. These wax models were used to form a mould which could be used to mould ceramic to form the lithophane. Such lithophanes were used as window 20 hangings, fire screens, teapot warmers and lamps.

From around the 1930's, there was no longer any great interest in lithophanes, and they are rarely seen today.

25 The present invention relates to an article having different thicknesses corresponding to the different intensities of an image, and to a method of forming such an article, the resulting article having a 30 similar appearance to a porcelain lithophane.

According to a first aspect of the present invention, a method of forming an article comprises the steps of:

determining the relative intensity at different points of an image; and

5 forming the article with different thicknesses corresponding to the different intensities of the original image from a translucent material.

In accordance with the present invention, it is possible to replicate a desired image, for example a photograph or computer generated image, into an article 10 such that the image can be observed with suitable lighting. This is possible by virtue of the step of determining the relative intensity of different points of the original image and the automatic use of this to form the final article with a variable thickness corresponding 15 to the relative intensities. This differs from lithophanes which were generated as works of art in their own right.

It is preferred that the determination of the 20 relative intensity of the different points of the image is achieved by scanning the image, for example into a computer. In this case, the original image may be divided into a number of picture elements, and an intensity value for each element determined.

25 The intensity values are then preferably stored in memory for subsequent use in forming the article. In this way, the original image can accurately be recreated in the article. By storing the intensity values in a memory, it is possible to process the values, for example to 30 normalise these, or vary these for different materials. It is also possible to enlarge or reduce the image, or to edit the image, for example by deleting parts of the image or combining images.

35 It is preferred that the step of forming the article comprises the step of forming a mould, and moulding the article in the mould. By moulding the

article, for example by injection moulding techniques, mass reproduction is possible. This allows the production of large volumes of product at a low cost, and 5 this in turn increases the number of uses for the article.

Preferably the step of forming the mould is carried out by a numerically controlled engraving 10 machine, such as a high speed three axis numerically controlled engraving machine. This can be loaded with the relative intensity values of the desired mould, and can cut any desired number of moulds. If a non-flat article is to be produced, a four or five axis 15 numerically controlled engraving machine may be needed. Alternatively, the mould may be formed by a laser cutting machine, by spark erosion in which a spark erosion electrode having a relief corresponding to the finished article is formed and is used to form the mould, or by 20 stereo lithography or other techniques. The use of these methods for forming the mould are especially suited to a method in which the data representing the relative intensity of the picture elements is held in a digital memory. In this case, the data can be used directly for 25 defining, for example, the cutter toolpaths or the stereo lithography. This allows for the rapid, reproducible and accurate formation of moulds for use in producing the finished articles. The accuracy allows greater detail to be seen in the finished article.

30

The mould is preferably formed from metal. This allows materials to be moulded which are heated to a high temperature to melt the material before being cooled to set. Such a mould may also have a long life to allow 35 for repeated mouldings. Alternatively, the mould may be a flexible mould, for example formed of rubber or polyethane. This is especially suitable where the

article is made from a fragile material, as it allows the article to be removed from the mould easily, for example by peeling off the mould, without damaging the article.

5

It is preferred that a number of moulds are formed from a single mould block to allow a large number of articles to be moulded simultaneously.

10

In an alternative example of the present invention, the article is formed by machining or otherwise forming the article directly from a translucent material based on the determined relative intensity so that the article has a relief such that the thickness corresponds to the different intensities of the desired image.

20

This method of forming articles does not allow for the same economy of scale and mass reproduction associated with moulding, but is able to produce limited quantities of articles having a specific design. For example, a person's image can be obtained from a digital camera or from a scanned photograph, and machined into an article. This will be difficult to replicate, and so can be used as a security or identification device.

30

The article may be formed by a number of methods, including those described above for the forming of a mould, including engraving by a numerically controlled engraving machine, by laser cutting, spark erosion or stereo lithography.

35

In a further example, the determined relative intensity data is used to form a die, punch or stamp. The die, punch or stamp, as with the mould, may be formed by machining, such as by a numerically controlled engraving machine, by laser cutting, spark erosion or by

stereo lithography. To form the article, the die, punch or stamp is pressed onto the surface of the material from which the article is to be formed, and leaves an imprint 5 in the material, giving the desired thickness variation for the article. Depending on the material used to form the article, the punch, die or stamp may be heated prior to being pressed into the material. These techniques are particularly suitable for the formation of articles 10 in which a moulding step is difficult in the context of the normal production process.

A material which is especially suitable for stamping is chewing gum which is usually formed in strips 15 that are cut to size. The stamping of a relief in a strip of chewing gum can be linked with the cutting of the strip to the required size. Especially where the article is formed in a strip, the punch, die or stamp may be provided on a roller.

20

Preferred materials from which the article may be formed include plastics, confectionery products including chewing gum, candy and chocolate, wax, soap and liquids.

25

A particularly preferred material is plastics. Such an article is advantageous over a porcelain lithophane in that it is significantly cheaper and easier to manufacture, does not require firing at a high 30 temperature and is less susceptible to damage. Further, by selection of a suitable material, it is possible to see the image clearly when the article is back lit by a particular type or intensity light source.

35

In the case of liquid, the liquid may remain in the mould to maintain the different thicknesses.

According to an alternative example of the present application, there is provided a plastics article having different thicknesses at different positions 5 corresponding to the relative intensity of an image, in which the plastics article transmits or emits light with an intensity corresponding to the thickness of the material.

10 The material from which the plastics articles are formed should be transparent or translucent, for example may be polystyrene, polypropylene, styrolux, ABS or acrylic or an epoxy, polystyrene or polyurethane resin. The plastics material is preferably filled with 15 a filler material such as china clay, chalk or other filter to give the desired effect.

20 The use of plastics is preferred since this is inexpensive, can be formed to the desired shape easily, for example by heating to make the material mouldable and cooling to set, and is resilient, making it less likely to break than porcelain. Plastics materials may also be used for a wide range of products for use in a large number and variety of environments.

25 Alternative materials from which the article may be formed include confectionery products, wax, soap and liquid.

30 Where confectionery products, for example chocolate, candy or chewing gum, is used, the finished articles can be eaten. As many confectionery products are shaped to give desirable appearance, little if any additional cost is required to form the product into an 35 article in accordance with the present invention, but the resulting article has a very attractive appearance, increasing its value.

Where the article is formed from liquid, it is preferred that the article comprises a container formed from substantially transparent material in which the

5 cross-sectional area between opposite walls corresponds to the relative intensity of the image, and liquid provided in the container. The container may be in the form of a bottle. The liquid may be a beverage or detergent or cosmetic, such as shampoo. To give the

10 desired effect, the liquid should preferably be of uniform density and transmissivity, and should be translucent.

The material from which the article is formed

15 may include luminescent particles or may be coated on the back by a luminescent layer. In this case, the luminescent particles emit light, and it may therefore be possible to view the image without light from a separate source being shone through the article. Where

20 luminescent particles are included, the lighter parts of the image may correspond to the thicker parts of the article and the darker parts to the thinner parts as, in this case, in the thicker regions there will be a greater amount of luminous particles and therefore there will be

25 a brighter section.

The article may be coloured. In this case, the article may be coloured with a single colour to give an overall tint, or there may be different colours at

30 different parts of the article to give parts of different colour.

Where the colour is a single colour, this may be achieved by including pigment in the material used for

35 the moulding. Alternatively, a coloured layer may be formed on a surface of the article. One surface of the article, for example the rear surface, will usually be

planar, and therefore a coloured layer can be formed on this surface easily, for example by transfer or sublimation printing or by an ink jet or silk screen printing technique. This will acts as a filter to the light passing through the article. Alternatively, a separate layer may be provided with the appropriate colours which is provided behind or in front of the article. This allows the colour to be formed separately.

10

The article may be formed from heat sensitive material. In this case, the image may only be seen when the article is heated. For example, if the article is formed into a lamp shade, it may be heated by the lamp to 15 become translucent.

The article according to the present invention can be used for a number of purposes, including character promotions, key rings, inserts to be provided in cereal 20 packets, light shades, plates, cups, toys, pictures etc. Where the article is made from an edible material, such as chocolate or candy, the article may be sold as a novelty food item. A candle can be formed where the article is made from wax.

25

By use of suitable processing techniques, the article may be a non-flat or three-dimensional article. It is also possible to produce a stereoscopic image by having two side by side articles having substantially the 30 same image but from a slightly different perspective, each of the images being viewed by a different one of the viewer's eyes.

In an alternative example, both surfaces of the 35 article include relief. In this case, the overall thickness of the material at any point corresponds to the relative intensity of the image at that point, however

the article is recessed on both sides. This gives an article which can be viewed from either side. Where the article includes one flat surface and the relief is provided exclusively in the other surface, the image can only be viewed properly from the relieved side of the article. Where both surfaces of the article include relief, it is preferred that the article is recessed on both sides to a generally similar amount. This eases the manufacture of the article. For example, where the article is formed in a mould, the two parts of the mould may be engraved as a mirror image of each other.

The article may be formed as a single piece, or may be formed in two parts which are fixed back-to-back. Where the article is formed in two parts and these are fixed back-to-back, such fixing may be by means of an adhesive, or may be by a mechanical interconnection or clamp. Where the article is formed in two parts, it is possible to provide a coloured or luminescent layer between the two parts before these are assembled together to give the desired colour filter or radiation of light as required.

Examples of the present invention will be described in accordance with the accompanying drawings, in which :

Figure 1 shows a schematic view of the system for forming an article;

Figure 2 shows a cross-section through a mould for forming an article;

Figure 3 shows a cross-section through an alternative example of an article; and,

Figure 4 shows a bottle of liquid including the features of the present invention.

As shown in Figure 1, an image 1, for example a photograph or painting, is scanned by a scanner 2 to convert the image 1 into electronic data which corresponds to the image 1. The data corresponding to 5 the scanned image is input to a processor 3. Alternatively, the image may be generated initially in electronic form, for example using a graphics package, or may be loaded from a store of pre-converted or generated images, for example from a CD-ROM, or downloaded, for 10 example from the Internet.

The processor 3 analyses the data corresponding to the image to determine the relative intensity, i.e. the relative darkness or lightness, at different points 15 or pixels of the image. This analysis may be achieved using commercially available computer aided design or computer aided milling software. This intensity information is provided to a numerically controlled milling machine from the software which is able to use 20 the intensity data to machine one half 11 of a mould in which the depth of the mould at different positions corresponds to the relative intensities of the original image. In a preferred example, the mould has a greater depth where the corresponding position of the original 25 image has a low intensity (i.e. where the image is dark), and has a shallower depth where the corresponding position of the original image has a high density (i.e. where the image is light).

30 The machined mould half 11 and an associated mould half 10 having a generally flat surface, are placed together to form a mould cavity, and plastics material is injected into the mould cavity. To give the plastics material the required translucent properties, a filler 35 material such as china clay, chalk or other filter material is added to the plastics before this is injected into the mould cavity.

When the plastics material has set, it is removed from the mould. The resulting article will be translucent, and will have a greater thickness in those 5 areas corresponding to darker areas of the original image than the areas corresponding to the lighter areas of the original image. When light is shone through the article from behind, the light is transmitted through the thinner parts of the article more easily than through the thicker 10 parts of the article, and therefore the thinner areas appear lighter than the thicker areas. This corresponds generally to the light and dark areas of the original image, and therefore an image corresponding to the original image can be seen.

15

The article may be coloured on the back by any suitable printing technique, for example by ink jet printing. In this case, the colour is easy to apply as it is applied to the flat rear surface of the article. 20 The coloured layer on the back of the article acts as a colour filter which only lets light of selected wavelengths pass through the layer and hence through the translucent article, and therefore the light viewed through the article is of certain colours. Where the 25 rear of the article is coloured substantially entirely with a single colour, the whole image viewed through the article will have a colour tint, however it is preferred that the rear of the article is selectively coloured with areas of different colour. This allows the light 30 transmitted through different parts of the article to be of different colours, which may correspond to the colours of the original image.

Alternatively, a coloured pigment may be added 35 to the plastics material before this is injected into the mould. In this case, the pigment within the plastics material will act as a filter to allow only light of

certain wavelengths to be transmitted to form the view image.

5 It is also possible to add a luminescent pigment to the plastics material used to injection mould the article. In this case, it is not necessary for a separate back light to be used to view the article, since the article will itself emit light. In this case, the 10 mould is made in reverse to that described above, with the areas corresponding to the lighter sections of the image being formed more deeply than the areas corresponding to the darker areas. In this case, the plastics article moulded by the mould will be thicker in 15 those areas corresponding to lighter areas of the original image, and therefore will have a greater amount of luminescent pigment, and therefore will emit more light than the thinner areas corresponding to the darker regions of the original image which will have less 20 luminescent material and therefore will emit less light.

An alternative example of an article according to the present invention is shown in cross-section in Figure 3. In this example, rather than the article being 25 formed with a flat rear surface and a front surface having a relief corresponding to the relative intensity of the different parts of the image, the article is formed with a corresponding relief on both faces. This can be achieved either by forming the two mould 30 halves with a corresponding, mirror image, relief, the relief in each part corresponding to half the required relief for the desired overall thickness of the finished product, or by engraving with a CNC machine. Alternatively, as shown in the example of Figure 3, the 35 article can be formed in two parts, each part having one flat face and one face with relief, each part made in accordance with any of the methods described herein.

In this case, the two parts of the article are fixed together in back-to-back relation. Due to the variation in thickness of the complete article, there will be a 5 similar transmission of light as with a single article having a flat rear face. However, it is possible to view the image through the article from either side, whereas when one face is flat, it is difficult to view the image from this flat face.

10

As shown in Figure 3, a coloured layer is printed on the flat face of one part of the article. In the complete article, this layer is sandwiched between the two parts of the article and therefore is not 15 susceptible to damage, for example by wear or scratching. The coloured layer may alternatively or additionally be a luminous layer, in which case it may not be necessary to hold the article to a light source when the image is viewed. The two parts of the article are then joined by 20 a suitable adhesive.

As with the first example, it is possible to provide a coloured or luminescent layer on one face of the article, or to make the article of a plastics 25 material including coloured or luminescent particles.

The injection moulded articles according to the present invention, which, due to the method of manufacture can be formed inexpensively and in large 30 numbers, can be used in many different applications, for example, but not limited to, character promotions, key rings, inserts to be provided in cereal packets, light shades, plates, cups, and pictures.

35 It may also be possible to form a plastics article having variable thickness or contour corresponding to the relative intensity of an original

image by engraving the article directly, for example using a CNC machine, in the same way as described above for forming the mould. In this case, it would be simple 5 to make one-off items, for example it would be possible to convert an image of a person's face into data relating to the relative intensity of the image, and directly engrave a plastics article with different thickness regions corresponding to the different intensities of the 10 image of the person's face. This could be used as a security device, for example as an identification card, which would be very difficult to forge.

In an alternative example, a bottle is formed 15 of transparent material in which the width of the bottle varies to correspond to the relative intensity of an image. When the bottle is filled with liquid, the amount of liquid will correspond to the relative intensity of the original image. Where the liquid is 20 translucent, this variation in the amount of liquid will give darker and lighter regions. A cross-section of a bottle is shown in Figure 4.

CLAIMS

1. A method of forming an article, the method comprising the steps of:
 - 5 determining the relative intensity at different points of an image; forming an article from a translucent material so that the article has a relief such that the thickness corresponds to the different intensities of the image.
- 10 2. A method according to Claim 1, in which the article has thicker portions corresponding to the darker regions of the original image, and thinner portions corresponding to the lighter regions of the original image.
- 15 3. A method according to Claim 1 or Claim 2, in which the relative intensities of the different points of the original image is determined by scanning the image into a computer.
- 20 4. A method according to any preceding claim, in which the image is analysed by dividing this into separate picture elements, and determining the intensity of each picture element.
- 25 5. A method according to Claim 4, in which a value corresponding to the intensity of each picture element is stored in memory.
- 30 6. A method according to Claim 5, in which the stored values are used to control a computer driven engraving machine to form the article.
- 35 7. A method according to any one of the preceding claims, in which the step of forming the article includes the step of forming a mould having a relief corresponding

to the relative intensity of the points of the original image and moulding the article from a translucent material in the mould to form an article having different thicknesses corresponding to the different intensities of 5 the original image.

8. A method according to Claim 7, in which the mould is formed of metal.

10 9. A method according to Claim 7 or 8, in which the step of forming the mould is an engraving step.

10. A method according to any one of Claims 1 to 6, in which the step of forming the article comprises the 15 step of engraving translucent material.

11. A method according to Claim 6, 9 or 10, in which the engraving step is achieved using a numerically controlled engraving machine.

20 12. A method according to Claim 6, 9 or 10, in which the engraving step is achieved using laser engraving.

25 13. A method according to any one of the preceding claims, in which the article is formed from a plastics material.

30 14. A method according to any one of Claims 1 to 12, in which the article is formed from a confectionery material, such as candy or chocolate.

15. A method according to any one of Claims 1 to 12, in which the article is formed from a soap.

35 16. A method according to any one of Claims 1 to 12, in which the article is formed from a wax.

17. A method according to any one of the preceding claims, in which the material includes luminescent particles.
- 5 18. A method according to any one of the preceding claims, including the further step of providing a luminescent layer on or in the article.
- 10 19. A method according to any one of the preceding claims, in which the article is formed of a coloured material.
- 15 20. A method according to any one of the preceding claims, including the further step of providing a coloured layer on or in the article.
- 20 21. A method according to any one of the preceding claims, in which the article is made from a heat sensitive material whose light transmissive properties vary dependent on the temperature of the material.
- 25 22. An article formed of a plastics material, the article having different thicknesses at different points corresponding to the relative intensity of an image.
23. An article formed of a confectionery product, such as candy or chocolate, the article having different thicknesses at different points corresponding to the relative intensity of an image.
- 30 24. An article formed of soap, the article having different thicknesses at different points corresponding to the relative intensity of an image.
- 35 25. An article formed of wax, the article having different thicknesses at different points corresponding to the relative intensity of an image.

26. An article comprising a container containing a liquid, the container being shaped to be of variable width, the width at different points corresponding to the 5 relative intensity of an image.

27. An article according to any one Claims 22 to 26, in which the material includes luminescent particles.

10 28. An article according to any one of Claims 22 to 27, in which a luminescent layer is provided on or in the article.

15 29. An article according to any one of Claims 22 to 28, in which the article is formed of a coloured material.

20 30. An article according to any one of Claims 22 to 29, in which a coloured layer is provided on or in the article.

25 31. An article according to any one of Claims 22 to 30, in which the article is made from a heat sensitive material whose light transmissive properties vary dependent on the temperature of the material.

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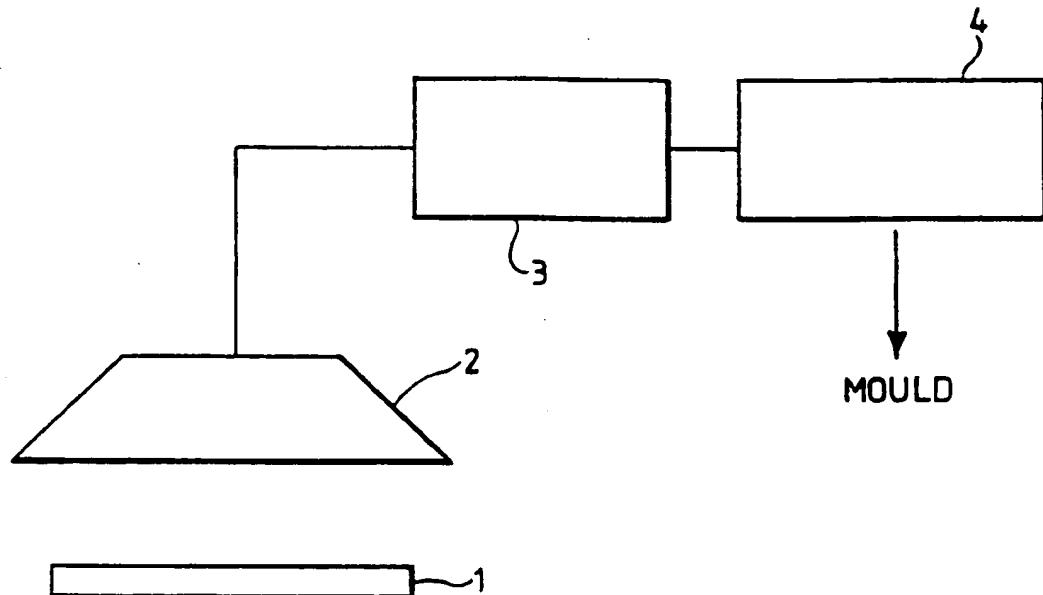


Fig.1.

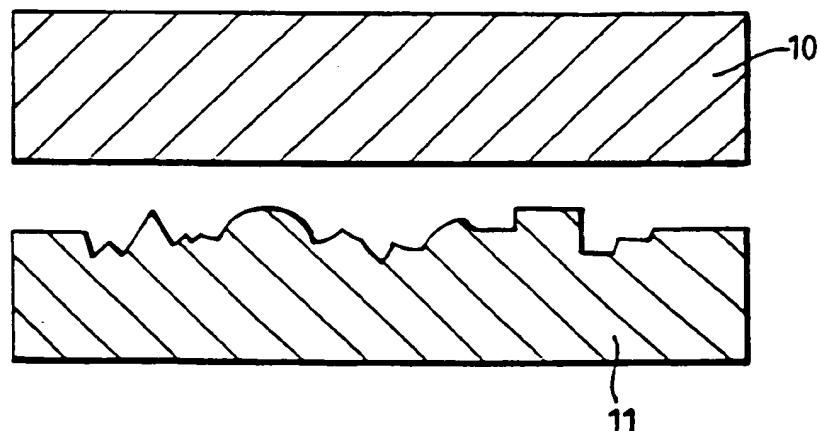


Fig.2.

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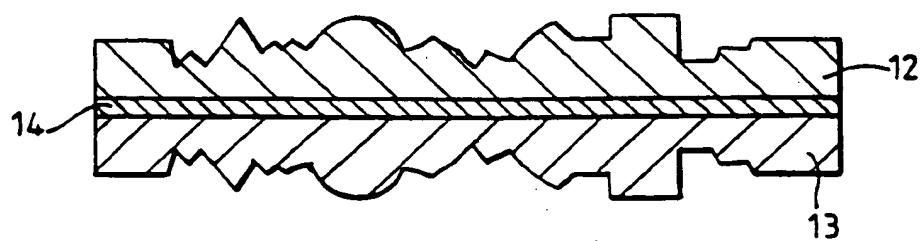


Fig.3.

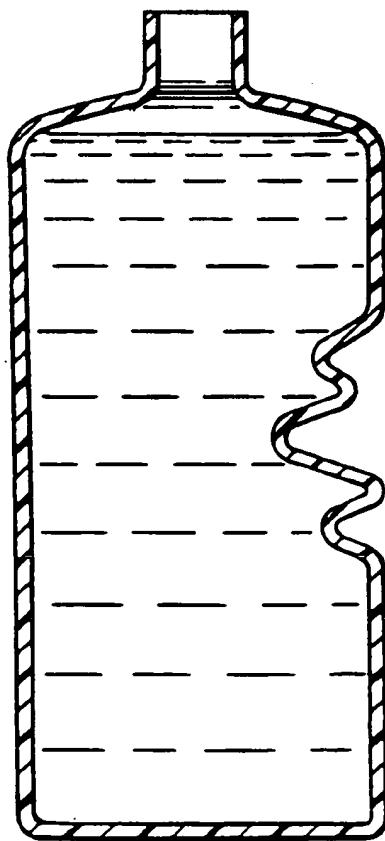


Fig.4.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 99/01936

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B29C33/38 G05B19/42 B44F1/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B29C G05B B23Q G06T B44C B44F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	EP 0 918 268 A (KRAL DIETER) 26 May 1999 (1999-05-26) the whole document	1-11, 19, 20, 22, 29, 30
X	EP 0 007 125 A (FORMA GLAS GMBH CO KG) 23 January 1980 (1980-01-23)	1-6, 10, 11
Y	the whole document	7-9, 12, 14, 17-21, 23, 27-31
Y	---	7-9, 12
A	WO 96 31315 A (POLIERWERKSTATT FUER STAHLFORM ;BESTENLEHRER ALEXANDER (DE)) 10 October 1996 (1996-10-10) the whole document	3, 4, 6
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- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *S* document member of the same patent family

Date of the actual completion of the international search

28 September 1999

Date of mailing of the international search report

12/10/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.
Fax: (+31-70) 340-3016

Authorized officer

Mathey, X

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 99/01936

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, Y	EP 0 917 035 A (WATANABE MASAHIRO) 19 May 1999 (1999-05-19) the whole document ---	14, 23
Y	GB 2 169 282 A (WAERMEGERAETE & ARMATURENWERK) 9 July 1986 (1986-07-09) the whole document ---	17-20, 27-30
Y	CN 1 063 255 A (QIU KUNZONG) 5 August 1992 (1992-08-05) abstract ---	21, 31
X	DE 81 975 C (MAX KRUSE) 15 June 1895 (1895-06-15)	1, 2, 13, 22
Y	the whole document ---	3-5, 7, 29
Y	GB 2 126 830 A (CALLER PETER MAURICE) 28 March 1984 (1984-03-28) the whole document ---	3-5
Y	EP 0 267 409 A (MAZZUCCELLI CELLULOIDE SPA) 18 May 1988 (1988-05-18) the whole document ---	7, 19, 29
X	US 4 469 725 A (FISCHER PAUL ET AL) 4 September 1984 (1984-09-04) the whole document ---	22
X	DE 69 449 C (F.A. SHAW) 12 July 1892 (1892-07-12) the whole document ---	1, 2
A	US 5 197 013 A (DUNDORF DAVID M) 23 March 1993 (1993-03-23) the whole document -----	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/01936

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
EP 0918268	A	26-05-1999	DE	19751966 A		27-05-1999
EP 0007125	A	23-01-1980	DE	2830189 A		24-01-1980
			DE	2916663 A		06-11-1980
			CS	207305 B		31-07-1981
			DD	144727 A		05-11-1980
			JP	55047248 A		03-04-1980
WO 9631315	A	10-10-1996	DE	29505985 U		20-07-1995
			AT	179107 T		15-05-1999
			AU	5269496 A		23-10-1996
			CA	2217372 A		10-10-1996
			DE	59601716 D		27-05-1999
			EP	0819036 A		21-01-1998
			EP	0854004 A		22-07-1998
			ES	2130808 T		01-07-1999
			JP	10508256 T		18-08-1998
EP 0917035	A	19-05-1999	CN	1217986 A		02-06-1999
GB 2169282	A	09-07-1986	DE	3539047 A		10-07-1986
			FR	2575422 A		04-07-1986
			IT	1184033 B		22-10-1987
			NL	8503201 A		16-07-1986
			YU	198385 A		30-04-1988
CN 1063255	A	05-08-1992		NONE		
DE 81975	C			NONE		
GB 2126830	A	28-03-1984		NONE		
EP 0267409	A	18-05-1988	IT	1197484 B		30-11-1988
			AT	54872 T		15-08-1990
			JP	2113709 C		06-12-1996
			JP	8002542 B		17-01-1996
			JP	63165110 A		08-07-1988
			KR	9508467 B		31-07-1995
US 4469725	A	04-09-1984		NONE		
DE 69449	C			NONE		
US 5197013	A	23-03-1993	CA	1339155 A		29-07-1997
			US	5703782 A		30-12-1997

PATENT COOPERATION TREATY
PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION <small>see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.</small>	
International application No.	International filing date (day/month/year)	(Earliest) Priority Date (day/month/year)
PCT/GB 99/ 01936	18/06/1999	05/10/1998
Applicant		
MYSTIX LIMITED et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

- the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:
- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. Certain claims were found unsearchable (See Box I).

3. Unity of invention is lacking (see Box II).

4. With regard to the title,

- the text is approved as submitted by the applicant.
- the text has been established by this Authority to read as follows:

LITHOPHANE-LIKE ARTICLE AND METHOD OF MANUFACTURE

5. With regard to the abstract,

- the text is approved as submitted by the applicant.
- the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

- as suggested by the applicant.
- because the applicant failed to suggest a figure.
- because this figure better characterizes the invention.

1 None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/GB 99/01936

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

MODIFICATIONS IN THE FOLLOWING LINES OF THE TEXT:

Line 1: ...A lithophane-like article and a method of forming such an article..
Line 4: ...image (1)...
Line 7: ...image (1)...

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/01936

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 B29C33/38 G05B19/42 B44F1/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 7 B29C G05B B23Q G06T B44C B44F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	EP 0 918 268 A (KRAL DIETER) 26 May 1999 (1999-05-26) the whole document ---	1-11, 19, 20, 22, 29, 30
X	EP 0 007 125 A (FORMA GLAS GMBH CO KG) 23 January 1980 (1980-01-23) the whole document	1-6, 10, 11 7-9, 12, 14, 17-21, 23, 27-31
Y	WO 96 31315 A (POLIERWERKSTATT FUER STAHLFORM ;BESTENLEHRER ALEXANDER (DE)) 10 October 1996 (1996-10-10) the whole document	7-9, 12
A	---	3, 4, 6 -/-

 Further documents are listed in the continuation of box C. Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 September 1999	12/10/1999
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl. Fax: (+31-70) 340-3016	Authorized officer Mathey, X

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/01936

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, Y	EP 0 917 035 A (WATANABE MASAHIRO) 19 May 1999 (1999-05-19) the whole document ---	14, 23
Y	GB 2 169 282 A (WAERMEGERAETE & ARMATURENWERK) 9 July 1986 (1986-07-09) the whole document ---	17-20, 27-30
Y	CN 1 063 255 A (QIU KUNZONG) 5 August 1992 (1992-08-05) abstract ---	21, 31
X	DE 81 975 C (MAX KRUSE) 15 June 1895 (1895-06-15)	1, 2, 13, 22
Y	the whole document ---	3-5, 7, 29
Y	GB 2 126 830 A (CALLER PETER MAURICE) 28 March 1984 (1984-03-28) the whole document ---	3-5
Y	EP 0 267 409 A (MAZZUCHELLI CELLULOIDE SPA) 18 May 1988 (1988-05-18) the whole document ---	7, 19, 29
X	US 4 469 725 A (FISCHER PAUL ET AL) 4 September 1984 (1984-09-04) the whole document ---	22
X	DE 69 449 C (F.A. SHAW) 12 July 1892 (1892-07-12) the whole document ---	1, 2
A	US 5 197 013 A (DUNDORF DAVID M) 23 March 1993 (1993-03-23) the whole document -----	1-12

INTERNATIONAL SEARCH REPORT

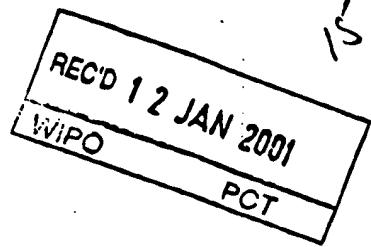
Information on patent family members

International Application No

PCT/GB 99/01936

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0918268 A	26-05-1999	DE 19751966 A	27-05-1999
EP 0007125 A	23-01-1980	DE 2830189 A DE 2916663 A CS 207305 B DD 144727 A JP 55047248 A	24-01-1980 06-11-1980 31-07-1981 05-11-1980 03-04-1980
WO 9631315 A	10-10-1996	DE 29505985 U AT 179107 T AU 5269496 A CA 2217372 A DE 59601716 D EP 0819036 A EP 0854004 A ES 2130808 T JP 10508256 T	20-07-1995 15-05-1999 23-10-1996 10-10-1996 27-05-1999 21-01-1998 22-07-1998 01-07-1999 18-08-1998
EP 0917035 A	19-05-1999	CN 1217986 A	02-06-1999
GB 2169282 A	09-07-1986	DE 3539047 A FR 2575422 A IT 1184033 B NL 8503201 A YU 198385 A	10-07-1986 04-07-1986 22-10-1987 16-07-1986 30-04-1988
CN 1063255 A	05-08-1992	NONE	
DE 81975 C		NONE	
GB 2126830 A	28-03-1984	NONE	
EP 0267409 A	18-05-1988	IT 1197484 B AT 54872 T JP 2113709 C JP 8002542 B JP 63165110 A KR 9508467 B	30-11-1988 15-08-1990 06-12-1996 17-01-1996 08-07-1988 31-07-1995
US 4469725 A	04-09-1984	NONE	
DE 69449 C		NONE	
US 5197013 A	23-03-1993	CA 1339155 A US 5703782 A	29-07-1997 30-12-1997

PATENT COOPERATION TREATY
PCT



INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference SH/JEC/44068	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)
International application No. PCT/GB99/01936	International filing date (day/month/year) 18/06/1999	Priority date (day/month/year) 05/10/1998
International Patent Classification (IPC) or national classification and IPC B29C33/38		
Applicant MYSTIX LIMITED et al.		

<p>1. This International preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input checked="" type="checkbox"/> Certain documents cited VII <input checked="" type="checkbox"/> Certain defects in the international application VIII <input checked="" type="checkbox"/> Certain observations on the international application

Date of submission of the demand 17/04/2000	Date of completion of this report 10.01.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Wich, R Telephone No. +49 89 2399 7517



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/01936

I. Basis of the report

1. This report has been drawn on the basis of (substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).);

Description, pages:

1-14 as originally filed

Claims. No.:

1-31 as originally filed

Drawings, sheets:

1/2-2/2 as originally filed

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: . which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
 - the language of publication of the international application (under Rule 48.3(b)).
 - the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
 - filed together with the international application in computer readable form.
 - furnished subsequently to this Authority in written form.
 - furnished subsequently to this Authority in computer readable form.
 - The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
 - The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
 the claims, Nos.:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB99/01936

- the drawings, sheets:
5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)): *(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*
6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims 7-9, 12-31
	No: Claims 1-6, 10-11
Inventive step (IS)	Yes: Claims 17, 18, 21, 27-28, 31
	No: Claims 7-9, 12-16, 19-20, 22-26, 29, 30
Industrial applicability (IA)	Yes: Claims 1-31
	No: Claims

2. Citations and explanations
see separate sheet

VI. Certain documents cited

1. Certain published documents (Rule 70.10)

and / or

2. Non-written disclosures (Rule 70.9)

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/01936

R_It_m_V

Independent method claim 1

Document EP-A-0 007 125 (D2) discloses

- a method of forming an article (cf. page 1; lines 9-10), the method comprising the steps of
- determining the relative intensity at different points of an image (see page 2; lines 3, 13)
- forming an article from a translucent material so that the article has a relief such that the thickness corresponds to the different intensities of the image (see page 2; lines 17-18).

The subject-matter of claim 1 is therefore not new and does not meet the requirements of Article 33(2) PCT.

Dependent claims 2-16, 19-20

Dependent claims 2-6 and 10-11 are disclosing features, that are also known from document D2 (for example the computer driven engraving machine according to claim 5. See page 4; lines 11-19).

These claims therefore do not meet the requirements of Article 33(2) PCT.

Dependent claims 7-9, 12-16 and 19-20 disclose features that appear to be known to the person skilled in the art and are therefore not considered to meet the requirements of Article 33(3) PCT.

For example the replacement of the article to be produced by a mould of metal according to claim 8 is just an adaption of the method of claim 1 employing common knowledge in the art of machining. Likewise, the employment of different materials for the article, like plastics material of claim 13, cannot be considered as involving an inventive step.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/01936

Independent product claims 22-26

D2 discloses an article formed of glass, the article having different thicknesses at different points corresponding to the relative intensity of an image (see page 2; lines 6-18, claim 1). Independent claims 22-26 differ therefrom only in that said article is formed of another material (plastics, confectionary product, soap, wax) or comprising a shaped container containing a liquid. However, the replacement of glass by any of the claimed materials or a liquid filled container only appears to be an option for the man skilled in the art bearing in mind the existence of already available articles consisting of these materials.

The subject-matter of the aforementioned claims is therefore not considered to involve an inventive step (Article 33(3) PCT).

Dependent claims 29-30

Dependent claims 29 and 30 disclose the employment of a coloured material or layer for the article. However, colouring of articles in either way is widely known in the art, making it obvious to a skilled person to apply it to the article as claimed.

The subject-matter of these claims does therefore not involve an inventive step (Article 33(3) PCT).

Industrial applicability

The subject-matter of the claims is obviously industrially applicable within the meaning of Article 33(4) PCT.

Re Item VI

Certain published documents (Rule 70.10)

Application No Patent No	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
D1= EP-A-0 918 268	26/05/1999	21/11/1998	24/11/1997

D1 is considered to disclose in combination the features of claims 1-11, 13, 20 and 22 of the application.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/01936

R It m VII

A document reflecting the prior art should have been identified in the according section of the description (Rule 5.1(a)(ii) PCT).

Re Item VIII

- 1 Although claims 22-26 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the material for which protection is sought. The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.

Hence, claims 22-26 do not meet the requirements of Article 6 PCT.

- 2 In order to overcome this objection, it would have appeared appropriate to define the relevant subject-matter in terms of a single independent claim for the article followed by dependent claims covering features which are merely optional (Rule 6.4 PCT).
- 3 Referring to the description and claim 1, the translucidity of the material of the article may be considered as an essential feature of the present application. Contrary to Rule 6.3 a) PCT, this feature is currently not present in claims 22-26 and should therefore have been included explicitly.
- 4 The expression "mould" should not be contained in Figure 1, in order to fulfill the requirements of Rule 11.11 a) PCT.
- 5 The reference signs 4 and 12-14 are not present in the description, contrary to Rule 11.13 I) PCT.